MATHEMATICS

Indiana
State Approved Course
Titles and Descriptions

Indiana Department of Education
Division of College and Career Preparation
151 West Ohio Street
Indianapolis, IN 46204

MATHEMATICS

Find the Academic Content Standards for this subject area at:
http://dc.doe.in.gov/Standards/AcademicStandards/index.shtml

Curriculum Resource Framework for this subject area at:
http://www.indianastandardsresources.org

Teacher Requirements for this subject area at:
http://www.doe.in.gov/educatorlicensing/pdf/AssignmentCode.pdf

ADVANCED MATHEMATICS, COLLEGE CREDIT
2544   *(ADV MTH CC)*

Advanced Mathematics, College Credit is a title covering (1) any advanced mathematics course offered for credit by an accredited postsecondary institution through an adjunct agreement with a secondary school or (2) any other postsecondary mathematics course offered for dual credit under the provisions of 511 IAC 6-10.
- Recommended Prerequisite: Algebra II and Geometry or Integrated Mathematics III
- Credits: 1 credit per semester. May be offered for successive semesters
- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- This course may be used for multiple dual credit college courses in mathematics
- Actual course title and university name may be appended to the end of the course title on the student transcript
  - *Example:* Advanced Mathematics, College Credit – Linear Algebra, IUPUI

ALGEBRA I
2520   *(ALG I)*

Algebra I formalizes and extends the mathematics that students learned in the middle grades. Five critical areas comprise Algebra I: Relations and Functions; Linear Equations and Inequalities; Quadratic and Nonlinear Equations; Systems of Equations and Inequalities; and Polynomial Expressions. The critical areas deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.
- Credits: A two credit course
- Fulfills the Algebra I/Integrated Mathematics I requirement for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- Students pursuing Core 40, Core 40 with Academics Honors, or Core 40 with Technical Honors diploma should receive credit for Algebra I by the end of Grade 9

ALGEBRA II
2522   *(ALG II)*

Algebra II builds on work with linear, quadratic, and exponential functions and allows for students to extend their repertoire of functions to include polynomial, rational, and radical functions. Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.
- Recommended Prerequisite: Algebra I
- Credits: A two credit course
- Fulfills the Algebra II/Integrated Mathematics III requirement for the Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas and counts as a Mathematics Course for the General Diploma

CALCULUS AB, ADVANCED PLACEMENT
2562   *(CALC AB AP)*

Calculus AB, Advanced Placement is a course based on content established by the College Board. *Calculus AB* is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multirepresentational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. The connections among these representations also are important. Topics include: (1) functions, graphs, and limits; (2) derivatives; and (3) integrals. Technology should be used regularly by students and teachers to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results. A comprehensive description of this course can be found on the College Board AP Central Course Description web page at:
http://apcentral.collegeboard.com/apc/public/repository/ap-calculus-course-description.pdf.
- Advanced Placement (AP) Courses are intended to be the equivalent to the comparable college level course.
- Recommended Grade Level: Grades 11 or 12
- Recommended Prerequisite: Pre-Calculus
- Credits: A two credit course, 1 credit per semester
- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

CALCULUS BC, ADVANCED PLACEMENT
2572   *(CALC BC AP)*

Calculus BC, Advanced Placement is a course based on content established by the College Board. *Calculus BC* is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multirepresentational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. The connections among these representations also are important. Topics include: (1) functions, graphs, and limits; (2) derivatives; (3) integrals; and (4) polynomial approximations and series. Technology should be used regularly by students and teachers

to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results. A comprehensive description of this course can be found on the College Board AP Central Course Description web page at: http://apcentral.collegeboard.com/apc/public/repository/ap-calculus-course-description.pdf.

- Advanced Placement (AP) Courses are intended to be the equivalent to the comparable college level course. The content of *Calculus BC* is designed to qualify the student for placement and credit in a course that is one course beyond that granted for *Calculus AB*.
- Recommended Grade Level: Grades 11 or 12
- Recommended Prerequisite: Pre-Calculus
- Credits: A two credit course
- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

COMPUTER SCIENCE A, ADVANCED PLACEMENT
(pending approval by the State Board of Education)
4570   (COMP SCI AP)

Computer Science A, Advanced Placement is a business mathematics course that provides students with the content established by the College Board. The course emphasizes object-oriented programming methodology with a concentration on problem solving and algorithm development, and also includes the study of data structures, design, and abstraction. The course provides students an alternative to taking pre-calculus or calculus to fulfill the four-year math requirement for graduation. A comprehensive description of this course can be found on the College Board AP Central Course Description web page at: http://apcentral.collegeboard.com/apc/public/repository/ap-computer-science-course-description.pdf.

- Advanced Placement (AP) Courses are intended to be the equivalent to the comparable college level course.
- Recommended Grade Level: Grades 11 or 12
- Recommended Prerequisites: Digital Communication Tools, Computer Applications, Algebra I, and Algebra II
- Credits: A two-credit course, 1 credit per semester
- Counts as a Mathematics Credit for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- Highly recommended that teachers attend an in-depth workshop on Computer Science AP before teaching this course

DISCRETE MATHEMATICS
2530   (DISCRETE)

Discrete Mathematics is an umbrella of mathematical topics. It is a course designed for students who will undertake higher-level mathematics in college that may not include calculus.
Topics include: (1) counting techniques, (2) matrices, (3) recursion, (4) graph theory, (5) social choice, (6) linear programming, and (7) game theory. Technology, such as computers and graphing calculators, should be used frequently.

- Recommended Prerequisite: Algebra II or Integrated Mathematics III
- Credits: A one or two credit course based on Indiana's Academic Standards for Discrete Mathematics (A one-credit Discrete Mathematics course includes counting techniques, matrices, and recursion with other topics included as time allows.)

- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

FURTHER MATHEMATICS STANDARD LEVEL, INTERNATIONAL BACCALAUREATE

2580 *(FMATH S IB)*

Further Mathematics Standard Level, International Baccalaureate includes geometry topic and four Mathematics Higher Level option topics: statistics and probability; sets, relations and groups; series and differential equations; and discrete mathematics.
- Recommended Grade Level: Grades 11 and 12
- Recommended prerequisites: students will have studied one of the four option topics from Mathematics Higher Level
- Credits: 2 semester course, 1 credit per semester
- Counts as a junior or senior Mathematics Course for the Core 40, Core 40 with Academic Honors, Core 40 with Technical Honors and International Baccalaureate diplomas or as an Elective for any diploma

GEOMETRY

2532 *(GEOM)*

Geometry formalizes and extends students' geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships, moving towards formal mathematical arguments. Six critical areas comprise the *Geometry* course: Congruency and Similarity; Measurement; Analytic Geometry; Circles; and Polyhedra. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school CCSS. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.
- Recommended Prerequisite: Algebra I
- Credits: A two credit course
- Fulfills the Geometry/Integrated Mathematics II requirement for the Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas and counts as a Mathematics Course for the General Diploma

INTEGRATED MATHEMATICS I

2554 *(INT MATH I)*

Integrated Mathematics I formalizes and extends the mathematics that students learned in the middle grades. The critical areas deepen and extend understanding of linear relationships, in part by contrasting them with exponential phenomena, and in part by applying linear models to data that exhibit a linear trend. Integrated Mathematics I uses properties and theorems involving congruent figures to deepen and extend understanding of geometric knowledge from prior grades. The final unit in the course ties together the algebraic and geometric ideas studied. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.
- Credits: A two credit course

- Fulfills the Algebra I/Integrated Mathematics I requirement for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

INTEGRATED MATHEMATICS II
2556   *(INT MATH II)*

Integrated Mathematics II focuses on quadratic expressions, equations, and functions; comparing their characteristics and behavior to those of linear and exponential relationships from Integrated Mathematics I. The need for extending the set of rational numbers arises and real and complex numbers are introduced so that all quadratic equations can be solved. The link between probability and data is explored through conditional probability and counting methods, including their use in making and evaluating decisions. The study of similarity leads to an understanding of right triangle trigonometry and connects to quadratics through Pythagorean relationships. Circles, with their quadratic algebraic representations, round out the course. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.
- Recommended Prerequisite: Integrated Mathematics I
- Credits: A two credit course
- Fulfills the Geometry/Integrated Mathematics II requirement for the Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas and counts as a Mathematics Course for the General Diploma

INTEGRATED MATHEMATICS III
2558   *(INT MATH II)*

Integrated Mathematics III provides students the opportunity to pull together and apply the accumulation of learning that they have from their previous courses. They apply methods from probability and statistics to draw inferences and conclusions from data. Students expand their repertoire of functions to include polynomial, rational, and radical functions. They expand their study of right triangle trigonometry to include general triangles. And, finally, students bring together all of their experience with functions and geometry to create models and solve contextual problems. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.
- Recommended Prerequisite: Integrated Mathematics II
- Credits: A two credit course
- Fulfills the Algebra II/Integrated Mathematics III requirement for the Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas and counts as a Mathematics Course for the General Diploma

INVESTIGATIVE GEOMETRY
2534   *(INVEST GEOM)*

Investigative Geometry provides the mathematical background, skills, and thinking processes necessary for the successful completion of Geometry. Emphasis is on an investigative study of basic properties of lines, angles, triangles, polygons, and circles as well as spatial relationships, inductive reasoning, and logical thinking. Drawing and interpreting planar and spatial phenomena, transformations, and geometric problem solving are also included. Use of graphing calculators and computer drawing programs is encouraged.

- Recommended Prerequisite: Algebra I
- Credits: A two credit course
- Counts as a Mathematics Course for the General Diploma only and as an Elective for the Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

MATHEMATICAL STUDIES STANDARD LEVEL, INTERNATIONAL BACCALAUREATE
2586   *(MA ST S IB)*

Mathematical Studies Standard Level, International Baccalaureate includes eight core topics: introduction to the graphic display calculator, number and algebra, sets, logic and probability, functions, geometry and trigonometry, statistics, introductory differential calculus, and financial mathematics.
- Recommended Grade Level: Grades 11 and 12
- Recommended prerequisites: students should have a good understanding of basic arithmetic, algebra, geometry, and trigonometry.
- Credits: 2 semester course, 1 credit per semester
- Counts as a junior or senior Mathematics Course for the Core 40, Core 40 with Academic Honors, Core 40 with Technical Honors and International Baccalaureate diplomas or as an Elective for any diploma

MATHEMATICS HIGHER LEVEL, INTERNATIONAL BACCALAUREATE
2582   *(MATH H IB)*

Mathematics Higher Level, International Baccalaureate includes seven core topics: algebra, functions and equations, circular functions and trigonometry, matrices, vectors, statistics and probability, and calculus. In addition, students also must complete one of the following four options: statistics and probability, sets, relations and groups, series and differential equations, or discrete mathematics.
- Recommended Grade Level: Grades 11 and 12
- Recommended prerequisites: students should have a strong understanding of arithmetic, algebra, geometry, trigonometry and statistics.
- Credits: 4 semester course, 1 credit per semester
- Counts as a junior or senior year Mathematics Course as required for Core 40, Core 40 with Academic Honors, Core 40 with Technical Honors and International Baccalaureate diplomas or as an Elective for any diploma

MATHEMATICS LAB
2560   *(MATH LAB)*

Mathematics Lab provides students with individualized instruction designed to support success in completing mathematics coursework aligned with *Indiana's Academic Standards for Mathematics*. It is recommended that *Mathematics Lab* is taken in conjunction with a Core 40 mathematics course, and the content of *Mathematics Lab* should be tightly aligned to the content of its corresponding course.
- Credits: A one to eight credit elective course
- Counts as an Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- Clarifying information can be appended to the end of the course title to denote the content covered in each course
  - *Example*: *Mathematics Lab* used to support students in *Algebra I* can be recorded on the transcript as *Mathematics Lab – Algebra I.*

MATHEMATICS STANDARD LEVEL, INTERNATIONAL BACCALAUREATE
2584 *(MATH S IB)*

Mathematics Standard Level, International Baccalaureate includes seven core topics: algebra, functions and equations, circular functions and trigonometry, matrices, vectors, statistics and probability, and calculus.
- Recommended Grade Level: Grades 11 and 12
- Recommended prerequisites: students should have a good understanding of arithmetic, algebra, geometry, trigonometry, and statistics.
- Credits: 2 semester course, 1 credit per semester
- Counts as a junior or senior Mathematics Course for the Core 40, Core 40 with Academic Honors, Core 40 with Technical Honors and International Baccalaureate diplomas or as an Elective for any diploma

PRE-ALGEBRA
(pending approval by the State Board of Education)
2508 *(PRE-ALG)*

Pre-Algebra provides the mathematical background, skills, and thinking processes necessary for the successful completion of Algebra. Topics include: (1) number sense and computation, (2) algebra and functions, (3) geometry, (4) measurement, (5) data analysis, and (6) probability. The instructional program of this course addresses both the understanding and use of the concepts in appropriate problem-solving situations.
- Credits: A two credit course
- Counts as a Mathematics Course for the General Diploma only or as an Elective for the Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- It is recommended that only students pursuing a General Diploma should enroll in *Pre-Algebra* in Grade 9. Other students needing remediation for Algebra I should enroll in *Algebra I* and *Mathematics Lab – Algebra I* to ensure they can complete the requirements for Core 40, Core 40 with Academic Honors, or Core 40 with Technical Honors diplomas.
- *Pre-Algebra* will no longer be an approved course after the 2011-12 school year.

PRE-CALCULUS/TRIGONOMETRY
2564 *(PRECAL/TRIG)*

Pre-Calculus/Trigonometry is a two-credit course that combines the material from *Trigonometry* and *Pre-Calculus* into one course. The foundations of algebra and functions developed in previous courses will be extended to new functions, including exponential and logarithmic functions, and to higher-level sequences and series. The course provides students with the skills and understandings that are necessary for advanced manipulation of angles and measurement. Students will also advance their understanding of *imaginary* numbers through an investigation of complex numbers and polar coordinates. The course is designed for students who expect math to be a major component of their future college and career experiences, and as such it is designed to provide students with strong foundations for calculus and other higher-level math courses.
- Recommended Prerequisite: Algebra II and Geometry or Integrated Mathematics III
- Credits: A two-credit course

- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

PRE-CALCULUS
2568   (PRECAL)

Pre-Calculus extends the course of study in algebraic reasoning past Algebra II (or Integrated Math III). The foundations of algebra and functions developed in previous courses will be extended to new functions, including exponential and logarithmic functions, and to higher-level sequences and series. This course will allow students to more accurately model real-life phenomena that are regular topics of discussion in college-level STEM courses. Students pursuing non-STEM careers will benefit from an increased understanding of mathematical modeling and data analysis, both of which are increasingly used in nearly all career fields.
- Recommended Prerequisite*: Algebra II or Integrated Mathematics III*
- Credits: A one-credit course (*Pre-Calculus* can be taken with Trigonometry to substitute for the two-credit *Pre-Calculus/Trigonometry* course)
- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

PROBABILITY AND STATISTICS
2546   (PROB/STAT)

Probability and Statistics includes the concepts and skills needed to apply statistical techniques in the decision-making process. Topics include: (1) descriptive statistics, (2) probability, and (3) statistical inference. Practical examples based on real experimental data are used throughout. Students plan and conduct experiments or surveys and analyze the resulting data. The use of graphing calculators and computer programs is encouraged.
- Recommended Prerequisite: Algebra II or Integrated Mathematics III
- Credits: A one credit course
- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

STATISTICS, ADVANCED PLACEMENT
2570   (STAT AP)

Statistics, Advanced Placement is a course based on content established by the College Board. The purpose of the AP course in statistics is to introduce students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data.   Topics include: (1) exploring data: describing patterns and departures from patterns (2) sampling and experimentation: planning and conducting a study, (3) anticipating patterns: exploring random phenomena using probability and simulation, and (4) statistical inference: estimating population parameters and testing hypotheses. The use of graphing calculators and computer software is required. A comprehensive description of this course can be found on the College Board AP Central Course Description web page at: http://apcentral.collegeboard.com/apc/public/repository/ap-statistics-course-description.pdf.
- Advanced Placement (AP) courses are intended to be the equivalent to the comparable college level course.
- Recommended Grade Level: Grades 11 or 12
- Recommended Prerequisite: Algebra II or Integrated Mathematics III

- Credits: 1 or 2 semester course. 1 credit per semester.   Due to the level of rigor, it is recommended that AP Statistics be offered as a 2 semester, 2 credit course. Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

TRIGONOMETRY

2566   *(TRIG)*

Trigonometry provides students with the skills and understandings that are necessary for advanced manipulation of angles and measurement. Trigonometry provides the foundation for common *periodic* functions that are encountered many disciplines, including music, engineering, medicine, and finance (and nearly all other STEM disciplines). Students will also advance their understanding of *imaginary* numbers through an investigation of complex numbers and polar coordinates. A strong understanding of complex and imaginary numbers is a necessity for fields such as engineering and computer programming.
- Recommended Prerequisite: Algebra II and Geometry or Integrated Mathematics III
- Credits: A one credit course (Trigonometry can be taken with Pre-Calculus to substitute for the two-credit Pre-Calculus/Trigonometry course)
- Counts as a Mathematics Course for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- A Career Academic Sequence or Flex Credit course